

REMARKS/ARGUMENTS

Claims 1-30 are pending. Claims 4-25 remain withdrawn. No new matter has been added.

Rejections Under 35 U.S.C. §103

Claims 1-3, 25-26, 28, and 30 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Yano* (U.S. Patent No. 5,138,415) in view of *Gross* (U.S. Patent No. 5,316,964). Claims 27 and 29 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Yano* and *Gross*, as applied to claims 1 and 26 above, and further in view of *Collins* (U.S. Patent No. 5,262,754). Applicant respectfully traverses these rejections.

Regarding Claims 1-3 and 26-30:

The Examiner contends (*Office Action*, page 3, second last paragraph) that one skilled in the art would be motivated to apply the heavily doped N-type diffusion region in the integrated circuit of *Gross* to the isolation diffusion region 17 in the photo-semiconductor device of *Yano* to realize the advantages of "increased isolation" as discussed in *Gross* (col. 2, lines 40-41 of *Gross*). Applicant respectfully submits that one skilled in the art at the time of invention of the subject application would not have been motivated to combine *Yano* and *Gross* to achieve the claimed invention.

First, the Examiner fails to provide an adequate reason as to why one skilled in the art would have combined the devices of *Yano* and *Gross* in the manner suggested by the Examiner. On point, the Supreme Court has recently emphasized - and recent Examination Guidelines have recognized - the importance of identifying reasons as to why one skilled in the art would combine the teachings of multiple references: "it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of

necessity will be combinations of what, in some sense, is already known." (*KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1741 (2007); see also *Examination Guidelines for Determining Obviousness Under 35 U.S.C. 103 in View of the Supreme Court Decision in KSR Int'l Co. v. Teleflex Inc.*, 72 Fed.Reg. 57526, 57529 (Oct. 10, 2007)).

One way to provide this reason is to show that there is "any need or problem known in the field of endeavor at the time of invention and addressed by the patent." (*KSR* at 1742). In the present case, the Examiner states that one skilled in the art would desire an "increase [in] the electrical isolation capabilities of the device [in *Yano*]." However, this reason is based on the necessary presumption that one skilled in the art would have recognized that the device of *Yano* had a problem which required increased isolation; i.e., the device of *Yano* had isolation problems between, for example, the photo-trigger thyristor 11 and semiconductor elements on an opposite side of the isolation diffusion region 17. *Yano* does not suggest such a problem. Indeed, *Yano* does not suggest any sort of problem whatsoever which would motivate one skilled in the art to apply a heavy doping to the isolation diffusion region 17. *Gross* also does not suggest such a problem. In particular, *Gross* relates to an entirely different device; i.e., an integrated circuit (which inherently operates at low voltages and integrates numerous elements and requires isolation between such elements) rather than a power device (which inherently operates at high voltages), and for an entirely different structure (as elaborated below). As such, *Gross* does not suggest an isolation problem with *Yano's* power device; *Gross* merely recognized a problem of insufficient isolation between resistors in integrated circuits (col. 2, lines 38-41). The Examiner has also failed to present any other references which remedy this deficiency of *Yano* and *Gross*.

A brief comparison of the present case with *KSR* is informative. In *KSR*, *Asano* (U.S. Patent No. 5,010,782) taught the majority of features of the claim in suit. *Asano* was directed to solving the constant ratio problem for an adjustable pedal and did not give any reason to put a sensor on this pedal. The Supreme Court in *KSR* nonetheless found the claim in suit obvious over *Asano* because the "prior art was *replete with patents* indicating that a fixed pivot point [of an adjustable pedal] was an ideal mount for a sensor." (*KSR* at 1742) (emphasis added).

Applicant respectfully requests the Examiner to provide prior art that suggests the need for a peripheral junction region formed at least partly within an isolation diffusion region of a power device.

Second, the problem to be solved by the technology in *Gross* is not portable to the technology of *Yano* or the claimed invention. *Yano* and the claimed invention are directed to devices in which vertical electrical currents pass between electrode terminals. On the other hand, *Gross* is directed to a device in which resistors and other semiconductor structures are laid out horizontally with respect to one another. While at first glance this appears to be a mere difference in orientation, closer scrutiny of the technologies illustrates that they are, for all practical purposes, in entirely different fields of endeavor. For example, in *Gross*, the inventors were attempting to increase isolation between multiple adjacently deposited but individually operable elements; i.e., resistors, transistors, etc. On the other hand, in the claimed invention, the inventors successfully modified the operating characteristics (i.e., blocking voltages) of a single device; i.e., a thyristor (or diode, or power device, etc., depending on the embodiment). The problem of increasing isolation between multiple adjacently deposited but individually operable elements is simply not applicable to the technology of *Yano* since there is no individually operable element on either side of a peripheral junction region; rather, the peripheral junction region as illustrated in, for example, figure 3 of the subject application, forms a part of the vertical structure of a single device - a thyristor.

Third, one skilled in the art would not be motivated to combine *Yano* in *Gross* as suggested by the Examiner since doing so would not realize predictable results. The Supreme Court recently stated - and the recent Examination Guidelines have recognized - that "a combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." (*Id.* at 1739; see also *Examination Guidelines* at 57527). However, the present case does not satisfy this category of obviousness. In particular, the heavily doped diffusion regions of *Gross* are used to increase the isolation between a resistor 23 and adjacent elements (e.g. NPN and PNP transistors). Consequently, by incorporating such diffusion regions into the isolation diffusion region 17 of *Yano*, one would merely predict that

the thyristor 11 and capacitor C1 would be better isolated from adjacent semiconductor elements, if any, located on the other side of the isolation region 17. One would not predict that the operating characteristics of the thyristor itself would be modified. Indeed, the inventors of the claimed inventions are believed to be the first ones to recognize the effect on operating characteristics of a thyristor and the like by incorporating peripheral junction regions as illustrated in, for example, figure 3. This is evidenced by the fact that *Yano* used an oxide film 28 that has a tendency to cause surface depletions in the isolation diffusion region 17 resulting in decreased reverse blocking voltages, but *Yano* failed to point out such problems and possible remedying effects of incorporating peripheral junction regions. On the contrary, such problems and remedying effects of a peripheral junction region are exactly what the inventors of the claimed invention recognized in their endeavor to expand wafer size while avoiding bending problems (see paragraphs [0029]-[0030] and [0039] of the subject application).

For at least these reasons, Applicant believes pending independent claim 1 is novel and inventive over the disclosure of the cited references. Pending dependent claims 2-3 and 26-30 are novel and inventive for at least the same reasons as claim 1 from which they depend. Applicant respectfully submits that claims 1, 2, 3, and 26-30 are allowable.

Regarding Claim 25:

The Examiner asserts that claim 25 is rejected as being unpatentable over *Yano* in view of *Gross*. However, Applicant respectfully submits that, in response to the Office Action dated May 4, 2004, claim 25 was withdrawn from consideration in Applicant's response to the USPTO dated May 27, 2004 via the provisional election of Species II.

Regarding Claim 28:

The Examiner asserts that *Yano* teaches, in figure 2, "a power device, comprising: ... wherein the peripheral junction region is provided to compensate the surface depletion of dopants in the isolation diffusion region." However, the Examiner also asserts, and Applicant agrees, that "Yano does not teach a peripheral junction region." Since *Yano* does not teach a

peripheral junction region, it would be difficult for *Yano* to teach a peripheral junction region "that is provided to compensate the surface depletion of the isolation diffusion region."

Further, *Gross* does not remedy these deficiencies of *Yano*. The heavily doped N-type diffusion region of *Gross* merely functions to isolate a resistor 23. It does not appear to compensate for a surface depletion of dopants. Even the combination of *Yano* and *Gross* fails to teach a peripheral junction region provided to compensate the surface depletion of dopants in the isolation diffusion region since there is no teaching or suggestion that the photo-semiconductor device in *Yano* experiences a surface depletion of dopants in the isolation diffusion region 17. Indeed, it is not likely that the devices in *Gross* and *Yano* experienced a significant surface depletion of dopants since such surface depletion was only recognized by the inventors of the present application as a result of a long diffusion step used to diffuse aluminum into the substrate (see [0032] of the subject application). Neither *Gross* nor *Yano* disclose such a long diffusion step much less the resulting surface depletion of dopants.

For at least these reasons, Applicant believes pending dependent claim 28 is novel and inventive over the disclosure of the cited references. Applicant respectfully submits that claim 28 is allowable.

Regarding claim 30:

The Examiner asserts that the prior art's device includes the device being a diode. However, neither *Gross* nor *Yano* either alone or in combination teach the device being a diode.

The device as claimed requires a semiconductor substrate, a first electrode terminal, a second electrode terminal; an isolation diffusion region, etc. (see pending claim 1). It is the combination of these elements which form the device, and consequently, it is the combination of these elements which form a diode in accordance with claim 30. In *Yano*, there is no similar combination of elements which forms a diode. Rather, the elements of *Yano* which allegedly correspond to the claimed device elements form a thyristor 11. The only diode disclosed in *Yano* is the Zener diode 14 illustrated in figure 2. This Zener diode fails to constitute the aforementioned combination since it only constitutes a P-well region 22, N+

impurity region 27 and electrode 34 (and thus does not constitute the claimed semiconductor substrate, second electrode terminal coupled to a second conductive region provided ... below the lower surface of the substrate, an isolation diffusion region, and a peripheral junction region). *Gross* fails to remedy the deficiencies of *Yano*.

For at least these reasons, Applicant believes pending dependent claim 30 is novel and inventive over the disclosure of the cited references. Applicant respectfully submits that claim 30 is allowable.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance and an action to that end is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 206-467-9600.

Respectfully submitted,

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